The Meteorological Magazine

Air Ministry :: Meteorological Office

Vol. 60
June 1925
No. 713

LONDON: PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE.

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Long Period Variations in the Rainfall of Great Britain

By C. E. P. BROOKS, M.Sc.

THE earliest known measurements of rainfall in this country date from 1677, in which year the record at Townley, near Burnley in Lancashire, commenced. This record continued with intermissions until 1704. Meanwhile, in 1697, a record was commenced at Upminster, Essex, which continued until 1716. From this date there was a gap of nine years, after which records began at Southwick, near Oundle, in 1726, and at Plymouth in 1727. Both these are overlapped by a long record from Lyndon, Rutland, commencing in 1737, and from that date there is no difficulty in carrying on the story. The records from 1726 onwards were collated by G. J. Symons, who published a well-known table of the annual variation in *British Rainfall* for 1870, but, owing to the gap, the earlier records could not be compared directly with this series, while the Plymouth record came to light after Symons had completed his calculations. The method employed by Symons was to calculate for each station the average for the period over which its records extended, and to express the rainfall for each year as a percentage of that average. The various series were then reduced to a common basis by means of corrections deduced from the years during which pairs of records overlapped. This process is sound if the records are truly homogeneous and if the stations are close together and overlap by a sufficient number of years, but it becomes hazardous

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when it is applied several times to isolated records and the overlapping periods are short. For example, the reduction from the average at Southwick to that at Lyndon is based on an overlap of only three years, of which 1737 was much wetter at Lyndon than at Southwick, while in 1738 and 1739 Southwick was slightly wetter than Lyndon. Hence some sort of a check seems to be necessary, and this was provided by expressing the early figures as percentages of the normal for the period 1881 to 1915, and comparing these figures with the percentages obtained by Symons. The results show very close agreement :—

		Percentages given by Symons.	Percentage of 1881-1915.
1726-1736	Southwick	99	97
1740-1760	Lyndon	78	78
1727-1752	Plymouth	83	84

This table is a remarkable testimony to the accuracy and judgment of the reductions carried out by Symons. It is reassuring on another point also. We know nothing as to the construction and exposure of these old gauges, but if they had recorded less than the correct amounts, the figures in the second column of percentages would have been lower than those in the first. The figures may be accepted as reasonably accurate, and this encourages us to accept also the figures for Townley and Upminster. These cannot be reduced to the present day normal by Symons' method, so that they have been compared directly with estimated normals for the period 1881 to 1915.

In this way we obtain the following figures of rainfall in percentage of present normal :—

1677 to 1686	Townley	89 per cent.
1689 to 1693	Townley	90 ,,
1697 to 1703	Townley and Upminister ..	91 ,,
1704 to 1716	Upminster	93 ,,
1726 to 1730	Southwick and Plymouth ..	100 ,,

The means for subsequent decades are shown in Table I. In this table the period 1731-1750 is a combination of the means given by Symons with the Plymouth data. From 1751 to 1868 the means given by Symons have been employed directly, and from 1869 to 1920 the means published in *British Rainfall*, 1923, have been employed.

Before the year 1677 no rainfall measurements are available. Estimates of the "wetness" could perhaps be obtained from various old weather journals, such as that of the Rev. William Merle, kept at Driby, Lincolnshire, from 1337 to 1344, and translated by G. J. Symons, but even this journal is not a true

diary, and for only a few months can the actual number of days with rain be counted. The general impression given by Merle's journal is that the weather was not greatly different from English weather at the present day, but it was not easy to derive any quantitative estimate from it. It is unfortunate that we have in England no striking annual phenomenon like the Nile Flood, which has been recorded annually, with only a few breaks, for fourteen centuries. We have to make the best of the records

TABLE I. RAINFALL MEANS BY DECADES.

Decade.	Percentage of 1881-1915 normal.	Decade.	Percentage of 1881-1915 normal.	Decade.	Percentage of 1881-1915 normal.
1731-40	84	1801-10	89	1861-70	98
1741-50	75	1811-20	98	1871-80	108
1751-60	86	1821-30	105	1881-90	99
1761-70	95	1831-40	99	1891-00	99
1771-80	100	1841-50	103	1901-10	99
1781-90	95	1851-60	98	1911-20	105
1791-00	97				

of the old chroniclers, who wrote down in their annals the noteworthy phenomena—floods, droughts and storms—which they witnessed or heard of. These annals have been studied by E. J. Lowe,* G. J. Symons† and, recently, by Sir Richard Gregory,‡ and from this material Table 2 has been prepared. Under the heading (*a*) Storms and Floods, are given the numbers of years in each half-century for which great wind-storms, heavy rains or extensive floods have been recorded ; sporadic summer thunderstorms have been omitted as far as possible. The numbers of droughts under heading (*b*) have been counted directly from Symons' work. The column headed "wetness" gives the percentage of the total records ($a + b$) which is formed by (*a*).

All such records are, of course, comparative. Suppose that after some centuries, during which the rainfall had been on the whole low and the storminess slight, there was a rather sudden change to heavy rainfall and great storminess, which persisted

* Natural phenomena and chronology of the seasons, London, 1870.
† Historic droughts, *British Rainfall*, 1887, p. 22.
‡ British climate in historic times. Geog. Teacher, Vol. 12, 1924.

for several more centuries. By the end of the first period dry fine weather would be accepted as the normal condition, hence when the change of climate set in, the chronicles would contain numerous references to floods and storms. After one or two generations of the new climatic regime, however, stormy weather would be accepted as the normal, and the number of references to floods and storms would again fall off. Evidently Table 2 can only be used in a qualitative sense.

The most remarkable fluctuation in the whole period, which occurred about the middle of the eleventh century, appears to have been just such a change in the general level of climate from calm and dry to stormy and wet. This change was not confined

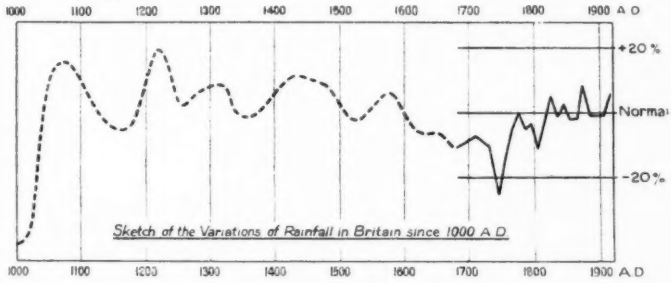
TABLE 2. FREQUENCY OF STORMS, FLOODS AND DROUGHTS.

Years.	(*a*) Storms and Floods.	(*b*) Droughts.	"Wetness."	Years.	(*a*) Storms and Floods.	(*b*) Droughts.	"Wetness."
1001-1050	2	3	40	1401-1450	3	1	75
1051-1100	9	1	90	1451-1500	3	6	33
1101-1150	4	10	29	1501-1550	2	6	25
1151-1200	1	3	25	1551-1600	10	12	45
1201-1250	8	7	53	1601-1650	8	15	35
1251-1300	8	13	35	1651-1700	20	22	48
1301-1350	3	7	30	1701-1750	17	29	37
1351-1400	3	7	30				

to Britain ; it is shown also in the Belgian records and in those for Europe in general. About this date the Norse sailors began to experience difficulty with ice on their way to and from Greenland, and the first record of severe ice in Danish waters was in 1048. Going further afield, we find a rapid rise in the level of the Nile about the same date. It seems that we are dealing here with a change of climate which was very extensive, if not world-wide.

The first half of the twelfth century gives us ten records of drought, and there appears no doubt that it was drier than 1051 to 1100, though probably not so dry as 1001 to 1050. The second half of the twelfth century has yielded few weather remarks, and was probably quiet and rather dry. In the first half of the thirteenth century we enter another period of great storminess and repeated floods. The culmination of this period was probably in the winter of 1218 to 1219, when the sea invaded

parts of Holland and Friesland, and gave the coast its present form. By contrast, the remainder of this century appeared quiet and dry; it includes a very severe drought in 1252. The oft-quoted storminess of the first half of the fourteenth century is not shown in Table 2. In Belgium and in central Europe this period appears to have been rather wet and stormy, but not phenomenal. According to E. Antevs it was cold and stormy in Sweden, while Ellsworth Huntington states that the levels of the Caspian and of Lake Lop-Nor, in central Asia, were high; on the other hand, the level of the Nile was rather low. Probably the tracks of depressions lay rather far north in western Europe, but then turned south-eastward into Russia, and crossed Asia in unusually low latitudes. The records of the period 1401-1450 in Britain are too few to be decisive, but the records from Belgium and the levels of the Caspian and Nile all point to a rather high rainfall during this half-century. After that date the fluctuations appear to have been less violent; there are indications of a maximum in 1551 to 1600 which is supported by the records from Belgium.



In the accompanying figure an attempt has been made at a graphical representation of the rainfall since 1000 A.D. The continuous curve at the right-hand end of the diagram is based on actual measurements, while the broken line has been sketched in from the records of storms, floods and droughts referred to above. The latter has, of course, no pretensions to quantitative accuracy, but is intended merely to suggest the probable nature of the variations from one half-century to another, and for this reason the horizontal lines indicating the scale are confined to the right hand end of the diagram, for which actual rainfall figures are available.

The Times states that the Davos Research Institute is arranging a Climatological Congress to be held there from August 17th to 22nd (see page V.).

OFFICIAL NOTICE

ADVANTAGE has been taken of the transfers of staff arising from the retirement of Dr. Chree (which was reported in our last issue) to regroup the work of the divisions housed at the Office at South Kensington. The supervision of the work of all the climatological stations, including the rainfall stations and the preparation of the serial statistical publications, the *Weekly Weather Report*, the *Monthly Weather Report* and *British Rainfall* will in future be undertaken by one division, which will be known as the British Climatology Division, while the task of dealing with the climatology of the world as a whole, including therein the supervision of the Library of the Office and the preparation of the *Réseau Mondial*, will be allotted to a separate division to which the name General Climatology Division has been assigned.

Mr. R. Corless will be in charge of the British Climatology Division, and Mr. C. E. P. Brooks, who has been promoted to the grade of Superintendent, will take charge of the General Climatology Division. Mr. Brooks will also act as Editor of this Magazine.

OFFICIAL PUBLICATIONS

The following publications have recently been issued :—

GEOPHYSICAL MEMOIRS.

No. 23. *The Climatology of Glasgow*, by L. Becker, Ph.D., Professor of Astronomy in the University of Glasgow. (No. 254c.)

This treatise is by way of being a model presentation of local climatology. The purpose of such a study is to provide answers to all the questions which may reasonably be anticipated as to the average weather experienced in any place, from the " man in the street," from the doctor, or from the meteorologist. Since questions are legion, they can only be answered by a variety of tables, hence the apparent disproportion between text and tabular matter. The statistics deal with barometric pressure, temperature, humidity, sunshine, cloudiness, visibility, and wind over a period of 50 years, and include monthly and five-day normals and serial values in standard form, and, in addition, a number of tables of special interest not usually found in works of this type. As examples of the latter we may quote : numbers of periods of warm weather and of frosty weather : frequencies of wet forenoons and afternoons at different times of the year : direction and velocity of the strongest gales.

The memoir is illustrated by photographs showing the exposures of the instruments, and by plates showing the annual and secular variations of the different meteorological elements.

No. 24. *The Distribution of Thunderstorms over the Globe.* By C. E. P. Brooks, M.Sc. (No. 254*d*.)

The frequency of thunder in various parts of the world is an important element in investigations relating to atmospheric electricity, and a knowledge of it is also useful in connection with the establishment of air routes. In this publication the monthly and annual frequency is discussed on the basis of records taken over a number of years at 3,265 stations, of which 2,680 are in Europe, together with a large number of observations on board ship. Maps are given showing the average frequency during the year, and also during October to March, and April to September. The monthly frequency in each of the continents and oceans and over the world as a whole is also shown in tabular form. It is considered that a station will probably record those thunderstorms which occur in a surrounding area of 200 square miles. If the earth's surface is considered as divided up into one million sections, each with an area of nearly two hundred square miles, there will be on the average sixteen thunderstorms in each area during a year, making a total of sixteen million thunderstorms a year, or 44,000 a day. If the average duration of a thunderstorm is an hour, there will be in progress at any one moment about 1,800 thunderstorms in different parts of the world. The diurnal variation and the variation in frequency with height are also briefly discussed.

Royal Meteorological Society

THE monthly meeting of this Society was held on Wednesday, May 20th, at 49, Cromwell Road, South Kensington, Mr. J. S. Dines, M.A., Vice-President, in the Chair.

Sir Gilbert Walker, C.S.I., F.R.S.—On Periodicity.

Since Schuster's classical papers on the periodogram, various modifications have been suggested, mainly with the purpose of shortening the calculations, and the value of these new methods under different conditions is discussed. Any series of numbers, such as a set of meteorological observations, can be resolved by these methods into a number of periodic terms. Hence it is necessary to have some criterion capable of application to a single series of data which will enable us to determine whether such periodic terms represent real recurrence of similar conditions after constant intervals, or whether they are merely due to the " accidental " run of the figures. This can be tested by comparing the amplitude with the greatest amplitude which may be expected from the analysis of a set of purely accidental numbers; such a test is, however, not applicable to series involving sudden alterations of phase or " discontinuities," and

the chief contribution of the paper is a new criterion of the reality of periodicities applicable to such series. This may be made clear by the following example. A periodicity of 3 to $3\frac{1}{2}$ years is suspected in the barometric pressure at Port Darwin; accordingly correlation co-efficients are worked out between the data for each quarter and those for $1\frac{1}{2}$, $1\frac{3}{4}$, 2.....$4\frac{3}{4}$, 5 years later. The coefficients are negative when the interval is $1\frac{1}{2}$ to 2 years, and show maximum positive values of 0·24 and 0·26 when the intervals are 3 and $3\frac{1}{4}$ years. Since several of the coefficients exceed those to be expected from a chance distribution of the figures, the reality of a period of about 3·15 years is accepted. The last part of the paper is devoted to a criticism of the "variable periodicities" found by H. W. Clough.

H. Jeffreys, F.R.S.—On Fluid motions produced by differences of temperature and humidity.

It has been shown that the maintenance of a difference of temperature between parts of the same level surface in a fluid will necessarily maintain a permanent motion of the fluid, and that heating or cooling a fluid at an internal boundary will also maintain a permanent movement, however these boundaries may be situated. A corresponding theorem is true for the supply of new constituents instead of heat. This result appears to contradict a theorem given by Sandström and Bjerknes, to the effect that a permanent motion is possible only if the place where the heat is supplied is at a lower level than where it is removed; but the arguments of these authors involve an unstated assumption, which seems to be untrue. If this assumption is not made, their argument leads to the result that the fluid moving from the lower temperature to the higher is at a lower level than that moving towards the colder regions. These inferences have been verified by working out fully a special case of the motion of a fluid in a closed pipe, heated on one side and cooled on the other. Sandström's experiment, in which no motion was observed in a tank under conditions suited to the production of a circulation, is found to be capable of a dynamical explanation based on the slowness of conduction and the consequent confinement of the currents to narrow regions where they would be very difficult to observe. It appears unlikely that it will often be possible to proceed by analogy from this experiment to the dynamics of wind, for radiation and turbulence will always redistribute the heat in such a way as to produce general currents; but there may be some applications to ocean currents.

The late F. W. Harmer—Further remarks on the meteorological conditions of the Pleistocene Epoch with a note by C. E. P. Brooks, M.Sc.

The chief difference between the North Atlantic and North

Pacific Oceans is that the former is open to the north, while the latter is practically closed to the north, since Bering Strait is too narrow and shallow to allow the passage of an appreciable current. Hence in the Atlantic the Gulf Stream travels north-eastward into the Arctic Ocean, while in the Pacific the Japan current is forced to turn south-eastward along the coast of America. This difference causes differences in the pressure distribution; both oceanic and atmospheric circulation combine to give western Europe a more genial climate than the west of North America. From this comparison it is concluded that the closing of the Greenland-Europe channel would bring about changes in the oceanic and atmospheric circulations which would suffice to cause a glacial epoch in Europe. The diversion of the storm tracks and the consequent alteration in the direction of the prevalent winds are probably even more important than the changes in the currents. The second part of the paper dealt with the climatic changes in the Mediterranean region during the glacial period, and it is argued that the crowding together of the isotherms in southern Europe caused a great increase of storminess there, to which was due the torrential rains of which we have evidence.

A. H. R. Goldie, M.A.—Gustiness of wind in particular cases.

The author attempts to classify wind eddies passing over the sea, and deals particularly with examples from the anemograph records of Falmouth Observatory during periods of southwest winds. It was found that the time interval of the rise and fall of the anemograph pen and of the breaking of the waves on the shore approximated to seven seconds. A further investigation, carried out at Lerwick, was an attempt to ascertain the normal relation between "range of gusts" and "hourly mean wind" in the case of equatorial currents. The ratio appears to be about one-third, and is nearly independent of velocity.

Correspondence

To the Editor, *The Meteorological Magazine*

Are Winters Changing?

So much is heard now-a-days as to the change of the English climate in an ordinary life-time that a few facts dealing wholly with temperature may be of general interest. Greenwich observations have been used, being representative of England, and the period dealt with is from 1841, which is of sufficient length to cover the memory of any now living. Unless so stated the winter is taken as the six months from October to March.

In the following table the winter temperatures are grouped

into periods of 10 years. The mean is for the ten winters and the difference from the average is a comparison with the Greenwich mean temperatures for 60 years.

Date.	Mean.	Difference from average.	No. of Years above | below average.		Average number of nights with frost.
	°	°	+	−	
1841-51	42·3	−0·1	4	6	49
1851-61	41·8	−0·6	3	7	53
1861-71	42·5	+0·1	6	4	48
1871-81	42·0	−0·4	5	5	54
1881-91	41·7	−0·7	4	6	55
1891-1901	42·8	+0·4	5	5	44
1901-11	42·9	+0·5	8	2	43
1911-21	43·5	+1·1	8	2	38
1921-25 (4 winters only)	43·5	+1·1	3	1	37

The excess of temperature for the periods subsequent to 1901 and the decrease in the nights with frost seem at first sight to suggest some increase of temperature in recent times.

Sir Richard Gregory in a recent Presidential Address to the Geographical Association on "British Climate in Historic Times" gives a table of mean air temperatures at different seasons in London for 150 years, 1770 to 1919. In this table the Greenwich temperatures were used when available. The winter, in this case referring to December, January and February, is practically the only season showing an increase of temperature in recent years. The mean temperature for the 10 years 1910-19 is 40·6°, which is 2·2° above the average for the 150 years and it is the highest of all the 10 year means.

Dealing with the temperatures from 1841 the warmest winter was that of 1898-99, having a mean of 45·4°, or 3° above the average for 60 years, in the winter which has just closed, 1924-25, the mean temperature was 44·4°, 2° above the average for 60 years; there have in all been only 7 warmer winters since 1841. The occurrence of warm winters seems to have been most pronounced since 1902-3. In the 23 winters since that date 19 have been warmer than the normal and 4 of these were warmer than last winter. There have been only 6 winters with the mean temperature for the 6 months below 40°, and no such cold winter has occurred since 1890-91; the coldest winter was 1844-45 with a mean of 38·8°.

When there are such divergent facts as 20 days with frost in the winter of 1922-23 and as many as 63 in the winter of 1923-24 any theory of change in climate seems dangerous.

CHAS. HARDING.

2, *Bakewell Road, Eastbourne. April 6th*, 1925.

[The abnormal warmth of the winters from 1911 to 1920 was much more pronounced in central Europe than in the British Isles. See the *Meteorological Magazine*, 57 (1922), 203.—ED. *M.M.*]

Mammato-Cumulus Clouds

ON April 22nd, 1925, at Sale, about five miles south of Manchester, I noted a perfect example of mammato-cumulus clouds. The individual mammillations were very dark-grey in colour, each being marked off from its neighbours by a bright ring of light. The impression was that of a squadron of so many balloons. The clouds were very low (below the alto layer), and drifted slowly on a west-south-west wind (about force three at ground level). The rear boundary was sharply defined by a straight line. The mammillations were best visible in the south-east quadrant, being less distinct in the north-east quadrant. The sky was nine-tenths overcast. The clouds in the western sky were nondescript. The mammillated clouds were first seen by me at 18 h. 40 m. (G.M.T.), but evidently they must have been visible earlier. By 19 h., they had drifted out of view. There was no thunderstorm (a slight thunderstorm to the south-south-east of Sale occurred at 16 h. 15 m. on April 23rd, the day after the above observation).

An examination of the Whitworth Observatory (Manchester) barogram, showed that air pressure had been falling steadily for some hours before my observation. The mammato clouds were also noticed independently at Urmston, a few miles north-west of Sale, by an individual with no meteorological knowledge. I can only remember two personal observations of mammato-cumulus during the last six years. The observation reported above was one of the most beautiful meteorological phenomena I have yet seen.

In view of Mr. Kidson's letter,* and of the correspondence in *Nature*, to which he refers, one may hope that one of our cloud experts will discuss the subject at greater length. In any event, the section on mammato-cumulus in the *Meteorological Glossary* (Fourth Issue, 1918, *pp.* 190-191), would seem to require revision, as the description appears to limit the cloud to Mr. Kidson's second type.

RAYMOND WHITEHEAD.

The University, Manchester. April 24th, 1925.

THE Institution of Water Engineers have awarded an Institution premium to Mr. J. Glasspoole, Ph.D., for his paper on "Fluctuations of Annual Rainfall: three driest consecutive years," read at the meeting on December 4th, 1924.

* In the *Meteorological Magazine*, 60 (1925), 39-40.

NOTES AND QUERIES

The Parkin Prize

THE following notice has been received from Dr. J. S. Fowler, Secretary of the Royal College of Physicians of Edinburgh :—

In terms of the Bequest made to the Royal College of Physicians of Edinburgh by the late Dr. John Parkin, Fellow of the College, a Prize is offered for the best Essay on certain subjects connected with Medicine.

The Subject of the Essay for the present period is, in terms of the deed—

"On the effects of volcanic action in the production of epidemic diseases in the animal and in the vegetable creation, and in the production of hurricanes and abnormal atmospherical vicissitudes."

The Prize is of the value of One Hundred Pounds Sterling, and is open to Competitors of all nations.

Essays intended for Competition, which must be written in the English language, to be received by the Secretary not later than 31st December, 1925. Each Essay must bear a motto, and be accompanied by a sealed envelope bearing the same motto outside, and the Author's name inside.

The successful Candidate must publish his Essay at his own expense, and present a printed copy of it to the College within the space of three months after the adjudication of the Prize.

May Thunderstorms

A TYPICAL period of thundery weather commenced, in the early hours of May 16th, at Brighton with a sharp storm which afterwards passed just east of London. On this and the following day the thunderstorms were very local, though they occurred as far north as the Shetlands. On the 18th and 19th thunderstorms were numerous over a large area in the British Isles and the Continent. In southern England they occurred chiefly during the afternoon and night of the 18th, and in the eastern districts on the following day. Parts of the Midlands experienced storms on both days. Rainfall was very heavy in places, with local flooding. At Witley, Mr. C. W. Dixon estimates that 38 mm. (1·5 in.) fell in 10 minutes during the afternoon of the 17th. This fall was extremely local, but totals of 25 mm. (1 in.) or more were recorded at several stations in the neighbourhood on the 18th. At Calshot (near Southampton) 34 mm. (1·34 in) fell on the night of the 18th, of which 16 mm. fell in 12 minutes. Thunder and lightning were severe in many of the storms, including one which crossed London from south-east to north-west shortly before midnight on the 18th.

The thunderstorms were associated with a shallow depression, which moved north-westward from France across the British Isles, and the gradual displacement of a warm south-easterly current extending to great heights by a colder westerly current. Many of the storms developed far in advance of this "cold front," which was not at all sharply defined, and there was no definite line squall.

The upper air observations for this period are of great interest. During the 27 hours ending 10h. on May 16th the temperature at 4,000 feet over south-east England rose 12° F., while in the middle layers of the troposphere it hardly changed, so that marked instability was developed, and air saturated at 4,000 feet and rising adiabatically would have found itself 15° F. warmer than the surrounding air when it reached 17,500 feet. Pilot balloon observations in south-east England and the Continent showed that the warm air current at 4,000 feet reached England from the south over a surface easterly wind, and had previously come from about east-south-east, probably originating in south-east Europe or the Mediterranean. Its relative humidity was high. Between the 16th and the 18th the changes in the upper air temperature and humidity were very small, but by the latter date the amount of instability was slightly less than on the former, so that the increased prevalence of thunderstorms must be attributed entirely to the "trigger" action of converging currents at the surface. On the morning of the 19th the boundary of the two currents was near Duxford, and temperature had fallen about 3° F. at all heights, the lapse-rate being unaltered. Pilot balloons showed that the surface south-west to west current undermined the south-east current and extended upwards, but no more observations of upper air temperature were obtained till the 21st, when it had fallen at all heights, the largest fall being 13° F. at 4,000 to 6,000 feet. The lapse rate was then of a type unsuitable for thunder, which was limited on that day to a few places in the north.

C.K.M.D.

"Derby Day Weather"

THE depression which arrived off the Hebrides from the westward on May 27th (Derby day) was of quite abnormal depth for the time of the year. Pressure was very low over the Hebrides both on that day and on the 28th, the actual lowest reading being 977·3 mb. (28·86 in.) at Castlebay at 18h. on the 28th. During the last half century readings below 980 mb. (28·94 in.) have occurred in the British Isles only three times in the second half of May and never in June. The previous occasions were on May 28th, 1877, when the barometer at Stornoway fell to the

low level of 968·8 mb. (28·61 in.); and on May 20th, 1887, and May 18th, 1920, when readings of about 979 mb. (28·91 in.) were obtained. This year's reading was thus the lowest for this season for 48 years.

A large rain area crossed the British Isles on the night of May 26th and on the 27th with considerable rainfall in all western districts and also in the neighbourhood of the English Channel. The passage of this rain area was timed in an unfortunate manner for south-east England where there was no sunshine and nearly continuous rain on the 27th. In spite of the depth of the depression gales were neither widespread nor severe though high winds were general along the south coast.

C.K.M.D.

Sea Fog over Land

On Easter Saturday, April 11th, 1925, there was a sea fog over the English Channel and there was more or less mist over all the low ground between the sea and the South Downs. By the road between Worthing and Littlehampton I noticed at several points that cloudy patches formed over the bare earth of the ploughed fields whilst the green fields were free from cloud, except for the general homogeneous mist. There was a wind of three or four miles an hour from the south. The cloudy patches dissolved quickly when they were carried from a ploughed field to a grassy one. My observations were made about mid-day. As it was fine on the other side of the Downs it may be presumed that there was clear sky above the mist. I should like to enquire whether the contrast between the appearance of sea fog over bare soil and over grass is well known to observers. Is it only noticed with a high sun? Is it necessary for the soil to be damp? Does it occur over light soils as well as heavy?

F.J.W.W.

Floods in Peru

A further account of the Peruvian floods has been received from the British Consulate at Callao by the courtesy of the Hydrographer of the Navy. The rainfall was very heavy along the northern and southern coasts of Peru, and most of the sugar crops in the north and cotton crops in the south have been destroyed through heavy floods inundating the fields and carrying off the growing crops with them. In the central regions the amount of rainfall measured on the coasts was small, but the rains of the Sierra above were very heavy, so that the river Rimac, on which the capital Lima stands, and which is the natural conduit to the sea for all mountain waters in this area, broke all bounds, washing away a large part of the railway and over-

throwing the principal electric generating stations at Chosica. Consequently, most factories have had to close down, and transportation of produce, &c., is difficult. The crushing mills in the north are also idle on account of the failure of the electric supply. The fact that under normal conditions no rain occurs at all along the coastal regions of the country makes the disaster more serious, for even in the larger cities the houses are constructed of nothing more durable than adobe or mud bricks, and in many of the smaller villages the huts are only of cane, or willow reeds, sufficient to keep out the rays of the sun.

It is interesting to note that the preceding visitation of this nature occurred in 1891, or thirty-four years ago. The Brückner cycle has been shown to influence the rainfall of Chile, and it is possible that the same cycle is to be found in Peru.

The Kite Record

AT Groesbeck,* in Texas, on December 11th, a kite reached the height of approximately 6,860 metres above ground, 7,000 metres above sea level. This exceeded all previous records for altitude above ground in the United States, although higher altitudes above sea level had previously been reached at other stations.

The Evolution of Climate

THE second edition of *The Evolution of Climate*, by C. E. P. Brooks (London: Ernest Benn, Limited, 1925, 8s. 6d. net.), contains an introduction in which the most important palæoclimatological work published during the years 1922 to 1924 is reviewed. Among this work we may notice the "solar-cyclonic" theory of climatic changes by Huntington and Visher; a discussion of the climatic history of the Antarctic from the earliest times, in the volume of the results of the British (Terra Nova) Antarctic Expedition, by C. S. Wright and R. E. Priestley; and an important work by H. Gams and R. Nordhagen on "Postglaziale Klima änderungen und Erdkrusten-bewegungen in Mitteleuropa." The last-mentioned publication sets out convincing evidence that the last phase of the Quaternary Ice Age, the Daun re-advance, occurred as late as 850 B.C., and thus came well within the historic period. Among the minor papers discussed is the most recent work of G. de Geer, on the absolute dating of the closing stages of the glaciation of America, in which it is shown from the thicknesses of the annual clay deposits by the thaw-water that the climatic fluctuations during certain stages of the retreat in North America ran so closely parallel with parts of the Swedish series as to be unquestionably of the same age.

*Washington, *M. W. Rev*, 1924, *p.* 599.

The Retirement of Dr. Chree

On the 5th May, 1925, Dr. Charles Chree, F.R.S., retired from the superintendentship of the Kew Observatory on reaching the age limit of 65. Dr. Chree was appointed Superintendent of Kew Observatory in 1893 and from that date Dr. Chree's history has been that of the Kew Observatory. The Observatory was then under the Kew Committee of the Royal Society and was responsible for a large amount of testing work in addition to magnetic and meteorological observations. Watches, chronometers, compasses, magnetic instruments, thermometers, barometers and optical instruments were tested and received "Kew Certificates." It is from the well-deserved reputation of the accuracy of these certificates, each bearing the Superintendent's signature, that Kew is so well-known to the British public.

In 1900 the National Physical Laboratory was founded and its first home was at the Kew Observatory. When, in 1910, new buildings were ready at Teddington and the National Physical Laboratory with the testing work was transferred there, the Observatory, with Dr. Chree still in charge as Superintendent, passed to the Meteorological Office. From this date Kew Observatory has remained in the true sense of the word an observatory, and regular observations and research in terrestrial magnetism, atmospheric electricity, meteorology and seismology have been its chief work. At the end of last year, owing to the ever increasing interference of London's electrical railways, the magnetic work had to be discontinued.

Dr. Chree's great powers as a physicist have been the predominating influence in maintaining the reputation of Kew Observatory during the last 32 years. His brilliant career at the universities of Aberdeen and Cambridge had prepared him for his work, and he has never ceased to produce valuable original work; his papers on terrestrial magnetism and atmospheric electricity have brought him world-wide fame. Although of a very retiring disposition Dr. Chree has never shirked the responsibilities which go with a dominating position in the scientific world, and he has filled the posts of President of the Physical Society and President of the Royal Meteorological Society and at present has the unique distinction of being President of both the international organisations which deal with the subjects of terrestrial magnetism and atmospheric electricity.

By the retirement of Dr. Chree the Meteorological Office loses one of the most distinguished and trusted members of its staff. Fortunately the loss is confined to the Meteorological Office and does not extend to Science, either in its national or international aspects. Dr. Chree is still a very young man in everything but years and experience. Science can therefore hope for much more service from him in the future, and it is not giving away

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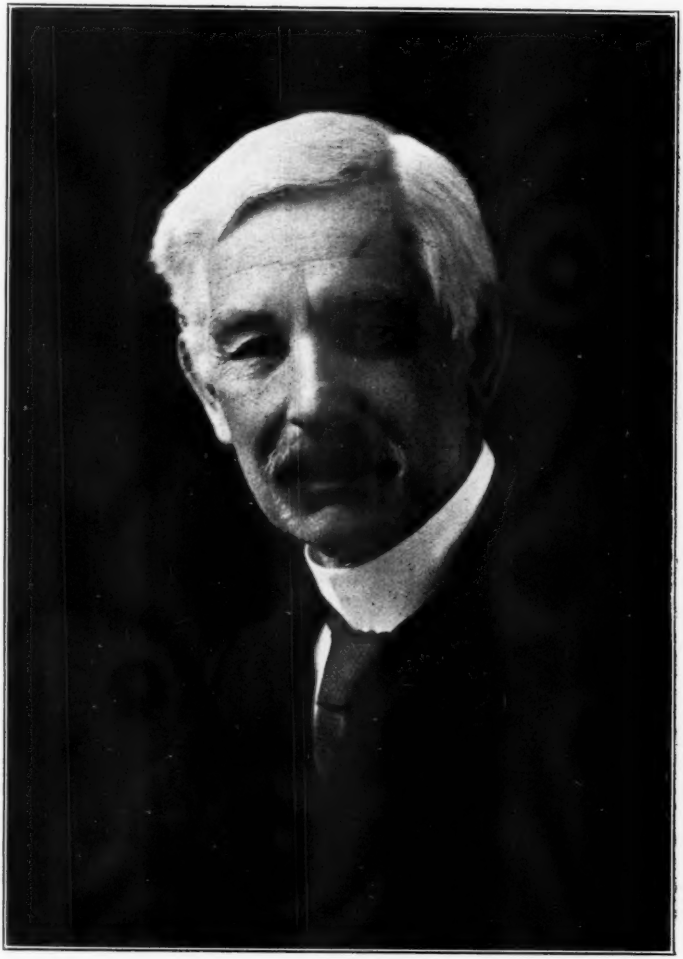

Elliott & Fry, Photographers

DR. C. CHREE, F.R.S.

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GEORGE MARWOOD WATSON, 1897-1925.

any secret to say that Dr. Chree has already made arrangements to continue several investigations on which he has already worked, but the completion of which has been delayed by the administrative work of the post which he has now relinquished.

Dr. Chree has already received many honours, amongst them the James Watt Medal of the Institution of Civil Engineers and the Hughes Medal of the Royal Society. It is the wish of every one of his late colleagues that he may have health and strength to gather still more of these marks of his distinguished service to geophysical science.

G.C.S.

Obituary

Father Aloysius Laurence Cortie, S.J.—At Stonyhurst, on May 16th, the death occurred of Father A. L. Cortie, at the age of 66. Father Cortie was born on April 22nd, 1859, and was educated at Stonyhurst College. He entered the Society of Jesus at Roehampton in 1878. In 1881 he joined the staff at Stonyhurst, and in 1919 was appointed Director of the College Observatory, taking charge of both the meteorological and astronomical activities.

Father Cortie was a distinguished astronomer, his main interest being concerned with the relation between sunspots and terrestrial magnetism, upon which subject he contributed many papers to the Royal Astronomical Society, thus carrying on the work done by his predecessor, Father Sidgreaves. In 1922 he was appointed a member of the Committee on the Solar Atmosphere at the Astronomical Union, and attended the Congress at Rome. Afterwards, as representative of Stonyhurst Observatory, he was made doctor of all the faculties of Padua on the occasion of the seventh centenary of the foundation of that University. He became a Fellow of the Royal Meteorological Society in 1924. His contributions to scientific journals and to the reports of the British Association were numerous. He was also a musician of no mean order, and for 19 years directed the music of the College.

Mr. George Marwood Watson.—By the death of Mr. G. M. Watson the Advisory Committee on Atmospheric Pollution has lost an enthusiastic and able worker. Mr. Watson commenced work with the Committee in February, 1919, and, except for an interval from December, 1919, to September, 1920, when he was incapacitated by illness, continued with the Committee until November, 1924, when failing health compelled him to cease work and return to his home at Grimsby, where he died on April 9th, 1925, at the age of 28. Mr. Watson was one of those rare men whose work is their chief pleasure; an able physical chemist, he had also a mechanical bent which was of great value in dealing

with the novel problems involved in the study of atmospheric pollution. These qualities, added to a character of transparent honesty, made him a man whom it will be difficult to replace. His early death has cut short a career of great usefulness, more especially as the researches in which he was engaged dealt with problems now recognised as of vital importance to the health and economic well-being of the community.

M. Camille Flammarion. M. Flammarion, the well-known French astronomer, died at the Juvisy Observatory on June 4th, at the age of 83 years. He is mainly known as a great popularizer of the science of astronomy, and many of his numerous works have been translated into English. In 1887 Flammarion founded the Astronomical Society of France. One of his hobbies was ballooning, and in 1872 he published a large work on meteorology entitled *L'Atmosphère* which was afterwards translated into English. The *Annuaire Astronomique et Météorologique*, edited by Flammarion, has now reached its sixty-first year.

News in Brief

We regret to learn of the death at Appenzell, at the age of 73 years, of M. Jakob Bommer, director of the Swiss Observatroy at Santis until 1919.

It was announced in the list of Honours awarded on the occasion of the King's Birthday that Vice-Admiral F. Learmonth, C.B., C.B.E., formerly Hydrographer of the Navy, and an ex-officio member of the Meteorological Committee, had been made a Knight Commander of the Order of the British Empire; and Mr. J. P. G. Rose (a member of the Meteorological Committee) a Companion of the Order of the Bath.

Lieut.-Col. J. U. Hope, D.S.O., R.A., has been appointed to the Meteorological Committee in place of Lieut.-Col. D. Clapham.

The Weather of May, 1925

THE weather of May was for the most part changeable and showery with many bright periods. Thunderstorms were of frequent occurrence and the rainfall was above normal. On the first of the month large amounts of sunshine were recorded—over 13 hours at Aberystwyth and Falmouth—but after this the weather became rather cool and cloudy with considerable rain at times as a depression moved slowly over the British Isles. As much as 30 mm. (1·2 in.) of rain were measured at Tiverton, Devon, on the 6th. Ground frosts were experienced in many places, the grass minimum temperature at Birr Castle (King's County) falling to 24° F. on the 5th. On the 10th a ridge of

high pressure began to spread north-eastwards from the Azores anticyclone with a consequent improvement in the general weather. Temperature rose to between 70° and 80° F. in many parts of England (*e.g.* 80° F. was recorded at London, Norwich and Margate on the 16th). In the extreme north of Scotland and in parts of Ireland, however, the skies continued cloudy and the temperature did not rise above 60° F. On the south-west coasts of England early morning fog was prevalent between the 13th and 16th. After the 16th another depression approached from the Atlantic and there was a renewal of thundery conditions. Thunderstorms were numerous over a large area in the British Isles and the Continent on the 18th and 19th and were associated with heavy rain; 45 mm. (1·76 in.) were recorded at Derby and 37 mm. (1·46 in.) at Calshot (Hants) on the 19th.* During the last ten days of the month pressure remained generally low† over the British Isles and changeable weather with local heavy rain prevailed. 74 mm. (2·93 in.) were recorded at L. Llydaw (Snowdon) on the 26th, and 36 mm. (1·43 in.) at Totennyworth Park (Sussex) on the 27th. Sunshine amounts of about 14 hours were also recorded during this period at many places but the temperature gradually fell, maximum readings round about 65° occurring during the last two or three days. In the extreme north the temperature did not reach 60° F. throughout the month, the highest reading at Wick being 57° F. During the last two or three days strong to high south-westerly winds were experienced in many parts of the kingdom, and gales were recorded in north-west Ireland throughout the 30th.

The total rainfall for the month was more than twice the normal at many places in the Midlands and the southern districts of England and in the central districts of Scotland and Ireland. In Argyll, it was more than three times the normal, *e.g.*, at Eallabus, Islay, it was 361 per cent. of the normal, and at Inveraray Castle 308 per cent.

Pressure was below normal over Europe and the North Atlantic with the exception of the greater part of Scandinavia where pressure was slightly above normal as also in Spitsbergen and in a belt from Bermuda to Spain. The deficit exceeded 5 mb. over the British Isles, part of Holland and most of Iceland and reached 10 mb. in north-east Ireland. Thie distribution favoured a southerly or south-westerly type of weather. Temperature was above normal in the British Isles and northern Europe, and rainfall was slightly in excess. In Sweden, the temperature was about 3° F. above normal and the rainfall distribution irregular, the greatest excess (20 to 30 mm.) being found in the western part of middle Sweden. Thunderstorms accompanied by heavy rain occurred in Holland early in the month; between the 1st

* See p. 116. † See page 117.

[*Continued on p.* 128.

Rainfall: May, 1925: England and Wales

CO.	STATION.	In.	mm.	Per-cent. of Av.	CO.	STATION.	In.	mm.	Per-cent. of Av.
Lond.	Camden Square.....	1·66	42	93	*War.*	Birmingham, Edgbaston	2·97	75	139
Sur .	Reigate, Hartswood...	2·18	55	128	*Leics*	Thornton Reservoir ..	5·07	129	252
Kent.	Tenterden, View Tower	2·71	69	173	,, .	Belvoir Castle.....	3·52	89	167
,, .	Folkestone, Boro. San.	1·96	50	...	*Rut .*	Ridlington.....	3·52	89	...
,, .	Broadstairs, St. Peter's	2·08	53	125	*Linc.*	Boston, Skirbeck	3·28	83	186
,, .	Sevenoaks, Speldhurst.	2·75	70	...	,, .	Lincoln, Sessions House	3·67	93	197
Sus .	Patching Farm.....	4·02	102	217	,, .	Skegness, Estate Office.	2·78	71	164
,, .	Brighton, Old Steyne .	...	..	...	,, .	Louth, Westgate	3·10	79	153
,, .	Tottingworth Park....	4·05	103	225	,, .	Brigg	3·78	96	202
Hants	Ventnor, Roy. Nat. Hos.	3·44	87	202	*Notts.*	Worksop, Hodsock....	3·49	89	175
,, .	Fordingbridge, Oaklnds	4·54	115	218	*Derby*	Mickleover, Clyde Ho..	5·56	141	282
,, .	Ovington Rectory	4·07	103	188	,, .	Buxton, Devon. Hos...	5·50	140	177
,, .	Sherborne St. John Rec.	3·67	93	189	*Ches.*	Runcorn, Weston Pt...	3·16	80	137
Berks	Wellington College...	2·98	76	160	,, ..	Nantwich, Dorfold Hall	4·61	117	...
,, .	Newbury, Greenham..	4·17	106	222	*Lancs*	Manchester, Whit. Pk.	5·12	130	241
Herts.	Bennington House....	2·32	59	123	,, ..	Stonyhurst College....	3·98	101	140
Bucks	High Wycombe	3·08	78	175	,, ..	Southport, Hesketh...	3·98	101	190
Oxf..	Oxford, Mag. College..	2·57	65	144	,, ..	Lancaster, Strathspey.	4·53	115	...
Nor .	Pitsford, Sedgebrook..	2·79	71	146	*Yorks*	Sedbergh, Akay	6·12	155	191
,, .	Eye, Northolm.....	3·62	92	...	,, .	Wath-upon-Dearne ...	3·14	80	155
Beds.	Woburn, Crawley Mill.	2·26	57	118	,, .	Bradford, Lister Pk...	4·48	114	214
Cam.	Cambridge, Bot. Gdns.	1·70	43	97	,, .	Wetherby, Ribston H..	4·50	114	217
Essex	Chelmsford, County Lab	2·16	55	150	,, .	Hull, Pearson Park ...	2·48	63	128
,, .	Lexden, Hill House...	2·44	62	...	,, .	Holme-on-Spalding ...	3·32	84	...
Suff .	Hawkedon Rectory ...	2·11	54	114	,, .	West Witton, Ivy Ho..	4·04	103	...
,, .	Haughley House.....	2·16	55	...	,, .	Felixkirk, Mt. St. John	3·39	86	180
Norf.	Beccles, Geldeston....	2·44	62	138	,, .	Pickering, Hungate ...	2·00	51	...
,, .	Norwich, Eaton	2·05	52	106	,, .	Scarborough.....	1·55	39	81
,, .	Blakeney	1·91	49	121	,, .	Middlesbrough	2·47	63	129
,, .	Swaffham	2·72	69	155	,, .	Baldersdale, Hury Res.	4·13	105	155
Wilts.	Devizes, Highclere....	3·60	91	199	*Durh.*	Ushaw College	2·61	66	121
,, .	Bishops Cannings	3·41	87	175	*Nor .*	Newcastle, Town Moor.	2·25	57	111
Dor .	Evershot, Melbury Ho.	4·06	103	199	,, .	Bellingham, Highgreen	4·58	116	...
,, .	Weymouth, Westham..	3·15	80	194	,, .	Lilburn Tower Gdns...	3·10	79	...
,, .	Shaftesbury, Abbey Ho.	4·87	124	231	*Cumb*	Geltsdale.....	4·02	102	...
Devon	Plymouth, The Hoe...	3·98	101	193	,, .	Carlisle, Scaleby Hall .	4·00	101	167
,, .	Polapit Tamar	4·59	117	227	,, .	Seathwaite M.....	14·60	371	198
,, .	Ashburton, Druid Ho..	5·52	140	205	*Glam.*	Cardiff, Ely P. Stn....	4·77	121	191
,, .	Cullompton	4·86	123	225	,, .	Treherbert, Tynywaun	9·84	250	...
,, .	Sidmouth, Sidmount ..	4·65	118	237	*Carm*	Carmarthen Friary....	7·55	192	273
,, .	Filleigh, Castle Hill ...	5·92	150	...	,, .	Llanwrda, Dolaucothy.	7·29	185	216
,, .	Barnstaple, N. Dev. Ath.	4·39	111	212	*Pemb*	Haverfordwest, School	4·53	115	181
Corn.	Redruth, Trewirgie ...	4·62	117	200	*Card.*	Gogerddan.....	...	..	...
,, .	Penzance, Morrab Gdn.	3·11	79	141	,, .	Cardigan, County Sch. .	3·88	99	...
,, .	St. Austell, Trevarna..	5·57	141	230	*Brec .*	Crickhowell, Talymaes	5·20	132	...
Soms	Chewton Mendip	4·74	120	172	*Rad .*	Birm. W. W. Tyrmynydd	5·96	151	174
,, .	Street, Hind Hayes ...	3·20	81	...	*Mont.*	Lake Vyrnwy	5·94	151	189
Glos..	Clifton College	4·65	118	221	*Denb.*	Llangynhafal	3·14	80	...
,, .	Cirencester	3·85	98	229	*Mer .*	Dolgelly, Bryntirion..	4·97	126	150
Here.	Ross, Birchlea	3·34	85	157	*Carn.*	Llandudno	3·15	80	166
,, .	Ledbury, Underdown.	3·04	77	149	,, .	Snowdon, L. Llydaw 9	12·97	329	...
Salop	Church Stretton.....	3·21	81	124	*Ang .*	Holyhead, Salt Island.	3·71	94	189
,, .	Shifnal, Hatton Grange	2·77	70	134	,, .	Lligwy	3·90	99	...
Staff.	Tean, The Heath Ho...	5·59	142	260	*Isle of Man*				
Worc.	Ombersley, Holt Lock.	2·88	73	140		Douglas, Boro' Cem...	4·69	119	185
,, .	Blockley, Upton Wold.	3·43	87	160	*Guernsey*				
War.	Farnborough.....	2·54	65	113		St. Peter P't, Grange Rd	4·79	122	282

Erratum: Geltsdale for April, 4·00 in. 102 mm.

Rainfall: May, 1925: Scotland and Ireland

CO.	STATION	In.	mm.	Per-cent. of Av.	CO.	STATION.	In.	mm.	Per-cent of Av.
Wigt.	Stoneykirk, Ardwell Ho	3·70	94	147	*Suth.*	Loch More, Achfary	5·15	131	113
,, .	Pt. William, Monreith	4·30	109	...	*Caith*	Wick	2·11	53	102
Kirk.	Carsphairn, Shiel.	8·73	222	...	*Ork .*	Pomona, Deerness	2·68	68	135
,, .	Dumfries, Cargen	6·21	158	206	*Shet .*	Lerwick	2·22	56	106
Dum	Drumlanrig	6·55	166	250					
Roxb	Branxholme	5·79	147	257	*Cork.*	Caheragh Rectory	6·86	174	...
Selk .	Ettrick Manse	10·06	256	...	,, ..	Dunmanway Rectory	6·71	170	197
Berk.	Marchmont House	4·05	103	164	,, ..	Ballinacurra	4·92	125	207
Hadd	North Berwick Res.	3·44	87	173	,, ..	Glanmire, Lota Lo.	4·24	108	173
Midl	Edinburgh, Roy. Obs.	4·29	109	245	*Kerry*	Valencia Obsy.	4·38	111	138
Lan .	Biggar	4·68	119	233	,, .	Gearahameen	10·40	264	...
Ayr .	Kilmarnock, Agric. C.	6·26	159	271	,, .	Killarney Asylum	4·69	119	153
,, .	Girvan, Pinmore	5·71	145	192	,, .	Darrynane Abbey	5·90	150	198
Renf.	Glasgow, Queen's Pk.	6·24	159	256	*Wat .*	Waterford, Brook Lo.	4·97	126	214
,, .	Greenock, Prospect H.	9·22	234	267	*Tip .*	Nenagh, Cas. Lough	4·99	127	202
Bute.	Rothesay, Ardencraig	7·78	198	257	,, .	Tipperary	4·28	109	...
,, .	Dougarie Lodge	6·30	160	...	,, .	Cashel, Ballinamona	3·69	94	154
Arg .	Ardgour House	11·43	290	...	*Lim .*	Foynes, Coolnanes	4·90	125	210
,, .	Manse of Glenorchy	8·74	222	...	,, .	Castleconnell Rec.	4·68	119	...
,, .	Oban	7·05	179	...	*Clare*	Inagh, Mount Callan	7·50	191	...
,, .	Poltalloch	6·79	173	235	,, .	Broadford, Hurdlest'n.	5·40	137	...
,, .	Inveraray Castle	12·09	307	308	*Wexf*	Newtownbarry	5·04	128	...
,, .	Islay, Eallabus	9·57	243	361	,, .	Gorey, Courtown Ho.	4·89	124	220
,, .	Mull, Benmore	10·80	274	...	*Kilk.*	Kilkenny Castle	4·45	113	201
Kinr.	Loch Leven Sluice	5·66	144	232	*Wic .*	Rathnew, Clonmannon	4·36	111	...
Perth	Loch Dhu	11·65	296	259	*Carl.*	Hacketstown Rectory	6·08	154	234
,, ..	Balquhidder, Stronvar	10·32	262	255	*QCo..*	Blandsfort House	5·30	135	218
,, ..	Crieff, Strathearn Hyd.	6·19	157	249	,,	Mountmellick	5·52	140	...
,, ..	Blair Castle Gardens	4·62	117	228	*KCo.*	Birr Castle	4·75	121	213
,, .	Coupar Angus School	3·51	89	144	*Dubl.*	Dublin, FitzWm. Sq.	5·15	131	268
Forf.	Dundee, E. Necropolis	3·77	96	180	,, .	Balbriggan, Ardgillan	4·06	103	195
,, .	Pearsie House	5·60	142	...	*Me'th*	Drogheda, Mornington	4·27	109	...
,, .	Montrose, Sunnyside	2·94	75	144	,, .	Kells, Headfort	5·58	142	207
Aber.	Braemar Bank	4·30	109	180	*W.M*	Mullingar, Belvedere	5·93	151	242
,, .	Logie Coldstone Sch.	3·43	87	138	*Long*	Castle Forbes Gdns.	6·69	170	259
,, .	Aberdeen, Cranford Ho	...	..	...	*Gal .*	Ballynahinch Castle	5·07	129	141
,, .	Fyvie Castle	2·90	74	...	*Mayo*	Mallaranny	5·05	129	...
Mor .	Gordon Castle	2·70	69	127	,, .	Westport House	5·23	133	183
,,	Grantown-on-Spey	1·99	51	85	,, .	Delphi Lodge	7·10	180	...
Na .	Nairn, Delnies	1·85	47	103	*Sligo*	Markree Obsy.	5·82	148	212
Inv..	Ben Alder Lodge	5·24	133	...	*Cav'n*	Belturbet, Cloverhill.	5·03	128	202
,, .	Kingussie, The Birches	2·90	74	...	*Ferm*	Enniskillen, Portora	5·57	141	...
,, .	Loch Quoich, Loan	11·30	287	...	*Arm.*	Armagh Obsy.	4·59	117	193
,, .	Glenquoich	10·53	267	192	*Down*	Warrenpoint	5·40	137	...
,, .	Inverness, Culduthel R.	3·55	90	...	,, .	Seaforde	5·12	130	195
,, .	Arisaig, Faire-na-Squir	7·54	191	...	,, .	Donaghadee, C. Stn.	4·03	102	178
,, .	Fort William	9·42	239	140	,, .	Banbridge, Milltown	4·09	104	182
,, .	Skye, Dunvegan	6·55	166	...	*Antr.*	Belfast, Cavehill Rd.	6·68	170	...
,, .	Barra, Castlebay	2·75	70	...	,, .	Glenarm Castle	5·35	136	...
R&C	Alness, Ardross Cas.	3·80	97	146	,, .	Ballymena, Harryville	5·30	135	185
,, .	Ullapool	2·68	68	...	*Lon .*	Londonderry, Creggan	3·68	93	140
,, .	Torridon, Bendamph.	6·02	153	132	*Tyr .*	Donaghmore	5·76	146	...
,, .	Achnashellach	6·64	169	...	,, .	Omagh, Edenfel	4·88	124	188
,, .	Stornoway	3·67	93	143	*Don .*	Malin Head	2·73	69	138
Suth.	Lairg	2·90	74	...	,, .	Rathmullen	3·82	97	...
,, .	Tongue Manse	3·97	101	167	,, .	Dunfanaghy	3·76	96	145
,, .	Melvich School	2·38	61	116	,, .	Killybegs, Rockmount	5·84	148	162

Erratum: Valencia for April, 5·72 in. 145 mm. 156 per cent.

Climatological Table for the British Empire, December, 1924

STATIONS	PRESSURE		TEMPERATURE							Relative Humidity	Mean Cloud Am'nt	PRECIPITATION			BRIGHT SUNSHINE	
			Absolute		Mean Values				Mean							
	Mean of Day M.S.L.	Diff. from Normal	Max.	Min.	Max.	Min.	½ max. and min.	Diff. from Normal	Wet Bulb.			Am'nt	Diff. from Normal	Days	Hours per day	Percentage of possible.
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0—10	mm.	mm.			
London, Kew Obsy.	1015·3	+ 1·6	55	31	47·9	39·8	43·9	+ 3·6	42·8	88	6·9	72	+ 14	18	1·5	19
Gibraltar	1023·2	+ 3·1	67	43	61·9	51·5	56·7	+ 0·7	53·4	80	5·5	63	− 79	12	...	...
Malta	1019·1	+ 3·2	67	49	61·9	54·5	58·2	+ 1·2	53·9	80	5·3	176	+ 90	18	4·9	51
Sierra Leone	1012·4	+ 1·2	90	67	87·7	71·5	79·6	− 1·9	73·9	69	3·4	0	− 37	0	...	...
Lagos, Nigeria	1009·1	− 1·4	91	73	88·2	75·6	81·9	+ 0·6	77·8	79	5·1	49	+ 28	4	...	...
Kaduna, Nigeria	1015·3	+ 2·5	100	...	89·3	...	...	...	58·9	43	1·3	0	− 3	0	...	...
Zomba, Nyasaland	1008·9	+ 0·3	97	63	87·4	67·2	77·3	+ 4·6	...	85	7·9	165	−126	16	...	...
Salisbury, Rhodesia	1008·6	− 0·8	85	56	77·4	60·2	68·8	− 1·1	63·5	73	7·1	295	+149	21	...	...
Cape Town	1013·6	− 0·7	94	55	80·8	62·2	71·5	+ 3·9	65·2	58	2·3	1	− 21	1	...	...
Johannesburg	1012·1	+ 0·5	80	47	72·3	54·0	63·1	− 2·0	57·0	76	7·3	146	+ 23	17	6·2	45
Mauritius	1014·1	+ 0·1	90	64	85·6	69·6	77·6	− 0·7	71·2	74	6·5	181	+ 61	11	7·3	55
Bloemfontein	...	...	88	50	79·2	57·2	68·2	− 3·6	61·3	66	4·7	116	+ 54	11	...	...
Calcutta, Alipore Obsy.	1016·3	+ 0·6	80	52	76·5	57·7	67·1	+ 0·6	58·4	87	3·4	0	− 5	0*	...	...
Bombay	1013·5	+ 0·2	88	65	84·9	70·5	77·7	+ 0·4	67·5	76	1·1	0	− 2	0*	...	...
Madras	1014·4	+ 0·9	85	63	83·1	68·1	75·6	− 0·9	70·6	81	3·1	22	−136	4*	...	...
Colombo, Ceylon	1011·0	+ 1·2	90	69	87·0	72·2	79·6	− 0·1	75·0	66	3·8	275	+135	11	9·0	77
Hong Kong	1019·2	− 0·5	73	52	67·4	57·4	62·4	− 0·6	54·9	61	4·0	18	− 13	4	7·7	72
Sandakan	...	...	89	72	86·6	74·3	80·5	+ 0·4	76·1	79	...	213	−236	7	...	...
Sydney	1013·0	+ 1·1	93	48	72·5	58·1	65·3	− 4·7	59·4	69	5·0	68	+ 1	12	7·2	50
Melbourne	1014·3	+ 1·8	104	43	72·9	52·8	62·9	− 1·4	56·7	59	4·9	75	+ 16	12	8·4	56
Adelaide	1014·9	+ 1·7	107	45	81·6	57·1	69·3	− 1·9	56·7	41	2·9	8	− 16	4	10·2	71
Perth, W. Australia	1014·3	+ 1·0	97	49	83·2	60·3	71·7	+ 1·1	61·6	53	2·1	0	− 15	0	11·1	78
Coolgardie	1013·1	+ 1·9	109	46	89·8	59·2	74·5	− 1·3	59·4	28	3·1	2	− 16	2	...	...
Brisbane	1012·4	+ 0·5	91	58	81·9	64·8	73·3	− 3·1	66·8	61	5·2	40	− 85	8	7·7	55
Hobart, Tasmania	1012·3	+ 2·6	81	40	65·6	48·9	57·3	− 3·1	51·1	63	6·1	24	− 26	11	8·0	53
Wellington, N.Z.	1007·6	− 4·5	75	46	65·6	53·7	59·7	− 0·8	55·1	74	7·4	289	+207	16	5·9	39
Suva, Fiji	1007·8	− 0·8	93	67	87·9	71·6	79·7	+ 0·8	73·5	78	5·2	257	− 51	22	...	...
Apia, Samoa	1008·4	0·0	89	71	84·1	74·3	79·2	− 0·1	76·7	77	5·7	393	+ 47	18	5·8	45
Kingston, Jamaica	1015·4	+ 1·4	89	65	86·8	68·4	77·6	− 0·1	71·1	68	4·5	14	− 27	3	...	...
Grenada, W.I.	1013·9	+ 2·0	84	70	81·9	72·6	77·3	− 0·8	72·5	77	5·3	192	+ 4	27	...	...
Toronto	1019·9	+ 2·5	53	− 2	30·2	17·7	23·9	− 2·3	21·1	40	7·3	59	− 13	18	2·0	22
Winnipeg	1023·2	+ 5·3	36	−29	3·8	−10·0	−3·1	− 8·8	...	...	5·4	18	− 6	8	2·4	29
St. John, N.B.	1015·0	+ 0·8	50	− 9	26·2	12·9	19·5	− 4·9	18·2	56	5·7	90	− 16	13	3·7	42
Victoria, B.C.	1021·2	+ 4·4	58	12	41·7	33·6	37·7	− 3·8	35·5	86	6·5	160	+ 10	18	2·8	33

* For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen.

St. John, N.B.	1015·0	+ 0·8	56	−5	29·2	12·9	19·0	− 1·4	32·2	86	6·5	160	+ 10	18	2·8	33
Victoria, B.C.	1021·2	+ 4·4	58	12	41·7	33·6	37·7	− 3·8	35·5	86	6·5	160	+ 10	18	2·8	33

* For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen.

Climatological Table for the British Empire for the Year 1924

STATIONS	PRESSURE		TEMPERATURE							Relative Humidity	Mean Cloud Am'nt	PRECIPITATION			BRIGHT SUNSHINE	
			Absolute		Mean Values				Mean							
	Mean of Day M.S.L.	Diff. from Normal	Max.	Min.	Max	Min.	½ max. and min.	Diff. from Normal	Wet Bulb.			Am'nt	Diff. from Normal	Days	Hours per day	Percentage of possible.
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0—10	mm.	mm.			
London, Kew Obsy.	1014·0	− 1·4	86	24	56·7	44·2	50·4	+ 0·7	48·0	79	6·9	786	+180	177	3·8	29
Gibraltar	1016·9	− 1·0	91	38	70·4	58·0	64·2	− 0·1	58·8	74	4·9	1117	+208	104	...	...
Malta	1015·5	+ 0·7	102	40	71·6	61·7	66·7	+ 1·5	60·9	75	3·8	577	+116	90	8·0	65
Sierra Leone	1012·3	+ 0·5	94	62	86·7	72·3	79·5	− 1·4	75·1	76	5·3	3802	−115	178	...	...
Lagos, Nigeria	1009·8	− 1·6	99	65	87·6	75·8	81·7	+ 1·5	77·5	76	5·6	1268	−552	101	...	...
Kaduna, Nigeria	1014·0	+ 1·6	100	...	89·1	...	...	...	69·5	67	1·0	1384	+ 38	122	...	...
Zomba, Nyasaland	1012·7	+ 0·6	97	46	80·3	60·2	70·3	+ 1·2	...	85	5·5	873	−538	107	...	...
Salisbury, Rhodesia	1012·7	− 0·6	92	33	77·9	53·1	65·5	+ 0·2	57·1	57	3·2	652	−156	72	...	...
Cape Town	1017·4	+ 0·4	100	36	71·2	53·9	62·5	+ 0·4	57·9	69	4·0	478	−170	94	...	...
Johannesburg	1017·3	+ 0·4	89	26	68·9	49·0	58·9	− 0·6	49·3	63	3·7	736	− 64	106	8·1	69
Mauritius	1015·8	− 0·3	91	54	79·8	67·2	73·5	− 0·5	68·3	76	6·0	1411	+150	167	7·2	60
Bloemfontein	...	...	101	18	73·3	46·1	59·7	− 1·7	50·2	63	2·7	618	+ 23	73	...	...
Calcutta, Alipore Obsy.	1007·3	− 0·2	111	52	89·0	72·6	80·8	+ 2·1	72·5	82	5·1	1297	−271	66*	...	...
Bombay	1008·4	− 0·7	95	61	87·1	75·7	81·4	+ 0·9	73·0	74	4·4	1326	−500	67*	...	...
Madras	1008·5	− 0·3	107	63	91·3	75·1	83·2	+ 0·3	75·2	73	4·8	1158	− 97	64*	...	...
Colombo, Ceylon	1009·5	+ 0·1	93	67	86·9	75·0	81·0	− 0·2	77·3	72	7·0	3109	+953	198	6·8	57
Hong Kong	1012·1	− 0·5	93	47	76·8	68·8	72·8	+ 0·5	67·6	77	7·0	2505	+392	141	5·5	46
Sandakan	...	...	93	70	87·5	75·2	81·4	+ 0·1	76·8	79	...	3215	+167	149	...	...
Sydney	1015·7	− 0·2	98	40	71·3	55·5	63·4	+ 0·4	57·1	66	4·8	939	−285	136	6·6	55
Melbourne	1015·9	− 0·4	104	33	65·5	49·4	57·4	− 1·0	53·1	68	6·3	926	+279	177	5·2	42
Adelaide	1017·1	0·0	107	35	71·0	51·8	61·4	− 1·6	53·7	58	5·1	596	+ 64	143	6·5	53
Perth, W. Australia	1016·7	+ 0·3	106	38	73·5	54·7	64·1	+ 0·1	56·6	62	4·4	858	+ 4	119	7·4	61
Coolgardie	1016·3	+ 0·3	109	33	77·3	51·3	64·3	− 0·2	54·9	40	3·5	196	− 62	45	...	...
Brisbane	1015·9	+ 0·2	100	41	78·0	60·5	69·2	+ 0·3	64·0	66	4·7	1044	−113	112	7·3	61
Hobart, Tasmania	1011·9	− 0·7	89	32	60·3	46·5	53·4	− 0·9	48·9	70	6·4	730	+128	196	5·6	46
Wellington, N.Z.	1015·9	+ 1·8	84	31	62·9	51·3	57·1	+ 1·7	?52·6	74	6·5	1249	+ 17	164	5·3	43
Suva, Fiji	1011·8	+ 0·4	93	62	82·4	71·3	76·9	− 0·1	73·3	81	6·3	4288	+1434	250	...	...
Apia, Samoa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kingston, Jamaica	1013·4	− 0·3	93	61	88·1	71·0	79·6	+ 0·3	73·0	69	5·5	995	+134	82	...	...
Grenada, W.I.	1013·6	+ 1·2	89	68	84·1	73·8	79·0	+ 0·3	74·4	76	4·8	2043	+116	227	...	...
Toronto	1016·2	− 0·2	90	− 6	53·0	36·3	44·7	+ 0·3	39·7	67	5·4	857	+ 7	156	5·8	46
Winnipeg	1016·7	+ 0·5	91	−31	44·9	25·5	35·2	+ 0·9	...	...	4·9	470	− 47	108	5·6	44
St. John, N.B.	1013·3	− 1·4	83	−19	48·4	33·4	40·9	− 0·3	37·6	75	6·0	991	−229	140	5·3	43
Victoria, B.C.	1018·0	+ 1·6	92	12	55·7	43·8	49·7	− 0·3	45·6	81	5·6	702	−125	136	6·2	47

* For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen.

[*Continued from p.* 123.

and the 6th 69 mm. of rain were measured at The Helder, where the average total for May is 43 mm. Heavy rain also occurred in Flanders causing floods locally. Severe storms were reported from Hungary on the 3rd and 11th; and on the 18th vineyards along the northern shores of the Lake of Bienna (Switzerland) were destroyed during a thunderstorm which also caused several landslides. On the 23rd, a small Turkish coasting steamer foundered in a storm at the entrance to the Bosphorus, forty-four of the passengers and crew being drowned, and a storm which swept over Anatolia on the 25th destroyed many buildings in Angora, Adana and Mersina. In eastern Persia the crop outlook is said to be bad, drought has affected the barley, while the opium crop has been damaged by cold. During the second half of the month the drought in Spain was broken and rain fell plentifully, in time to save the spring crops.

Rainfall was above normal in Australia with the exception of Western Australia and the northern part of Queensland where it was a little below. In the coastal regions of New South Wales, it was very heavy, varying from about twice the normal on the north coast to eight times the normal on the Upper Murrumbidgee, where floods occurred, the damage done being estimated at about £500,000. The drought in the west of the province was broken by beneficial rains during the latter part of the month.

High temperatures were recorded generally in the United States about the middle of the month, but northerly winds caused a sudden fall of temperature on the shores of Lake Superior on the 23rd and along the whole of the southern shores of the Great Lakes on the 24th, *e.g.*, the maximum reading at Duluth was 68° F. on the 22nd and 32° F. on the 23rd, and at Toledo (Ohio) 88° F. on the 23rd and 42° F. on the 24th. May 24th this year is stated to have been the coldest Empire Day in Ontario for 75 years.

The special message from Brazil states that the rainfall distribution was irregular in the northern and central regions, the total for the month in both districts being 18 mm. below normal, while in the south the rainfall was plentiful with 22 mm. above the normal. The pressure distribution of the month was characterized by the passage of a few large slow-moving anticyclones. The condition of the crops was generally good. Pressure at Rio de Janeiro was 0·4 mb. above normal and temperature 1·3° F. above normal.

Rainfall May, 1925—General Distribution

England and Wales ..	178	per cent. of the average 1881-1915.
Scotland	191	
Ireland	194	
British Isles	185	